REMARKS

Claims 1-29 are pending in this application. claims 1-29 have been rejected. Claims 30-31 are new. In view of foregoing amendments and following remarks, the applicants request allowance of the application.

CLAIM REJECTIONS UNDER 35 U.S.C. § 112

Claims 1-29 are rejected under 35 U.S.C. § 112 , first paragraph, as failing to comply with the written description requirement and §112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter.

The Office Action, at pages 2-3 asserts "Applicants original disclosure ... on page 7, paragraph 25 ... is a statement of what the next-line predictor does and does not say that the checking predictor uses the same components as the next line predictor."

Applicants would like to point to, for example, page 4, paragraph 18 of the original disclosure, which recites, in part:

> FIG. 1 shows a timing diagram 20 in which a *current next-line prediction 22 is generated based on a previous next-line prediction* 24, and a *current checking prediction 26 is generated based on the previous next-line prediction* 24.

(emphasis added). Accordingly, one of ordinary skill in the art would be apprised that the checking predictor may use some of the same components as the next line predictor since both the current next-line prediction 22 and the current checking prediction 24 are generated based on the previous next-line prediction 24. Furthermore, because the checking predictor and the next line predictor are both branch predictors, one of ordinary skill in the art would recognize that their respective branch predictions may depend upon similar factors. Applicants respectfully request withdrawal of the rejection.

The Office Action, at page 4, further asserts "the description of the checking predictor is so limited as to preclude one of ordinary skill from constructing **applicants checking predictor** and, as a result, practicing applicants' invention." (emphasis in the original). Applicants respectfully disagree with the assertion. Claim 18, for example, recites in part:

> a next-line predictor to generate a current next-line prediction
> ***based on a previous next-line prediction***; and

> a checking predictor to generate a current checking prediction
> ***based on the previous next-line prediction ... the checking predictions to
> be independent from one another and to have a longer latency than the
> next-line prediction***

The Office Action appears to be confused by the names the Applicants attributed to the claimed branch predictors, i.e., the "next-line predictor" and the "checking predictor." However, any branch predictor may be used as the claimed "next-line predictor" and "checking predictor." As highlighted above, in this embodiment both the claimed next-line predictor and checking predictor generate a branch prediction based upon the same previous prediction, i.e., the claimed "previous next-line prediction." That is, the claimed embodiment uses two branch predictors to generate two branch predictions; a next-line predictor to generate a current next-line prediction based on a previous next-line prediction and a checking predictor to generate a current checking prediction based on the previous next-line prediction, the checking predictions being independent from one another. Applicants respectfully submit that one of ordinary skill in the art at the time the invention was made understands how to generate a branch prediction. Further, as is evident by the lack of any art cited against the present application, there is no evidence that a "branch prediction architecture comprising: a next-line predictor to generate a current next-line prediction based on a previous next-line prediction; and a checking predictor to generate a current checking prediction based on the previous next-line prediction ... the checking predictions to be independent from one another and to have a longer latency than the next-line prediction," as recited in claim 18, was disclosed prior to the filing of the present application.

Further, claim 19, for example, further recites:

> a front end comparator to ***compare the current checking prediction to the
> current next-line prediction,*** and to ***update the next-line predictor*** based
> on the current checking prediction ***if the current next-line prediction does
> not have a target address that corresponds to a target address of the
> current checking prediction***

Accordingly, in this embodiment, the branch prediction generated by the next-line predictor can be compared to (i.e., <u>checked</u> against) the branch prediction generated by the <u>checking</u> predictor and when the branch predictions do not match, the next-line prediction can be updated. One

benefit of the claimed embodiment, for example, is that because the checking predictor branch predictions have a longer latency that the next-line predictor branch predictions, the checking predictor branch predictions can be more accurate than the next-line branch predictions. Applicants respectfully submit that one of ordinary skill in the art would appreciate that the longer a branch predictor may take to generate a prediction the more accurate the prediction will be because more factors can be taken into account. Accordingly, because the embodiment employs a next-line predictor, which has less latency that the checking predictor, in addition to the checking predictor, the branch prediction architecture can generate both a quick branch prediction (next-line prediction) to maintain a high level of throughput in a processor and a more accurate branch prediction (checking prediction) to correct branch prediction errors made by the quicker branch predictor.

An Information Disclosure Statement (IDS) is filed. Applicants request that the Examiner review the article entitled "Prophet/Critic Hybrid Branch Predictions," published after the present application was filed, which discusses a branch prediction system using more than one branch predictor and may aid the Examiner's understanding of the claimed embodiments.

Withdrawal of the rejection to the specification and to the claimed is respectfully requested.

NEW CLAIMS

New claim 30 is directed to a branch prediction architecture, including:

a first branch predictor generating a first branch prediction based on a previous branch prediction;

a second branch predictor generating a second branch prediction based on the previous branch prediction, and generating a subsequent branch prediction based on the first branch prediction, the predictions generated by the second branch predictor being independent from one another; and

a comparator comparing the first branch prediction to the second branch prediction, and updating the first branch prediction based on the second branch prediction if the first branch prediction does not have a target address that corresponds to a target address of the second branch prediction, wherein the first branch predictor generates the first branch

prediction in a single clock cycle and the second branch predictor
generates the second branch prediction over multiple clock cycles.

Support for the new claim can be found, for example, at page 4, paragraph [18] to page 5,
paragraph [20] and in FIGS. 1-3.

New claim 31 is directed to a method of predicting instruction branches, including:

generating, in a single clock cycle, a first branch prediction based
on a previous branch prediction;

generating, over multiple clock cycles, a second branch prediction
based on the previous branch prediction,

comparing a target address of the first branch prediction to a target
address second branch prediction, and

updating the first branch prediction based on the second branch
prediction if the target address of the first branch prediction does not
corresponds to the target address of the second branch prediction.

Support for the new claim can be found, for example, at page 4, paragraph [18] to page 5,
paragraph [20] and in FIGS. 1-3.

Favorable consideration of claims 30-31 is respectfully requested.

CONCLUSION

All outstanding rejections have been overcome. It is respectfully submitted that, in view of the foregoing amendments and remarks, the application is in clear condition for allowance. Issuance of a Notice of Allowance is earnestly solicited.

Although not believed necessary, the Office is hereby authorized to charge any fees required under 37 C.F.R. § 1.16 or § 1.17 or credit any overpayments to Deposit Account No. 11-0600.

The Office is invited to contact the undersigned at 202-220-4200 to discuss any matter regarding this application.

Respectfully submitted,

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